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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/18/2006

Hiroaki Misawa

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7590

07/16/2010

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EXAMINER

DUCLAIR, STEPHANIE P.

ART UNIT

PAPER NUMBER

1713

NOTIFICATION DATE

DELIVERY MODE

07/16/2010

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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<b>Office Action Summary</b>	<b>Application No.</b> 10/585,845	<b>Applicant(s)</b> MISAWA ET AL.	
	<b>Examiner</b> STEPHANIE DUCLAIR	<b>Art Unit</b> 1713	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 12 March 2010.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 4-6 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-2, 4-6 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>03/12/2010</u> .  | 6) <input type="checkbox"/> Other: _____                          |

### DETAILED ACTION

1. This is the second office action on the merits.
2. Claims 1-2 and 4-6 are pending before the Office for review.
3. In the response filed March 12, 2010  
Claims 1 and 4-6 were amended  
Claim 3 was canceled  
No new matter is present.

### ***Claim Rejections - 35 USC § 103***

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
5. Claims 1, 2 and 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over URAIRI et al (JP 2003-236929) in view of ZHAO et al (Fabrication of Microstructures Using Shrinkable Polystyrene Films) and VENKATAKRISHNAN (Laser writing techniques for Photomask Fabrication Using a Femtosecond Laser).
6. **With regards to claim 1**, URAIRI discloses a method of applying a pulse laser beam to a plastic exhibiting a glass phase transition by heating for forming an induced structure part (pattern) ( Page 4 [0009], [0010], Page 9 [0027] Applicant's Specifications Page 1 Background Art).
7. However, URAIRI does not disclose applying a femtosecond pulse laser beam, wherein the formed laser processed pattern is only scaled down by the heat treatment without its shape changing and a method step of heat treating the plastic material to be

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processed at a temperature not lower than a glass transition temperature  $T_g$  to fine (scale down) the formed patterns by heat shrinkage, which the formed laser process pattern is only fined by the heat treatment without its shape changing.

8. ZHAO, discloses a method to reduce the feature size (fine) of microstructures and to fabricate microstructures of various materials by heating the patterned film to a temperature a few degrees above the glass transition temperature (Page 209, Section I. Introduction). ZHOA further discloses that a rectangular shape was change during shrinking to either a rectangular or rhombic shape depending on the alignment (Page 212, Section 3.2, and Figure 3). While ZHOA does not explicitly disclose maintaining the shape, ZHOA further explains that complex shapes (*i.e. the square*) can be fabricated by controlling the extent and direction of the shrinkage of the patterned PS films (Page 215, Section 4. Conclusion). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention that shape (whether maintaining it or distorting it) could be determined by controlling the extent and direction of the shrinkage of the patterned film.

9. VENKATAKIRISHNAN discloses a method for patterning a photomask comprising patterning the photomask with a femtosecond laser rather than traditional lithographic processes (Page 493, Abstract and Introduction)

10. It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to have modified the method of URAIRI to include the temperature of ZHAO because it allows the thermal shrinkage of patterned polystyrene (plastic) films

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which provides the basis for a wide flexibility of patterns produced (Page 215, Section 4 Conclusion).

11. It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to further modify the method of URAIRA to further include the femtosecond laser of VENKATAKIRISHNAN because the reference of VENKATAKIRISHNAN teaches that the use of a femtosecond laser is less time consuming and will produce a higher resolution in a less sensitive photoresist.

12. **With regards to claim 2**, URAIRA discloses a method in which a plastic material to be processed has a formed laser processed pattern.

13. ZHAO discloses a method in which the formed laser processed pattern is not lost by heat treatment (Page 212, Section 3.2, and Figure 3).

14. **With regards to claim 4**, URAIRI discloses a method of applying a pulse laser beam to a plastic exhibiting a glass phase transition by heating for forming an induced structure part pattern. However URAIRI, does not disclose a method of heat treating the plastic material to be processed at a temperature (T) equal to or great than the  $T_g$  and equal to or lower than  $200^{\circ}\text{C} + T_g$  ( $T_g \leq T \leq T_g + 200^{\circ}\text{C}$ ).

15. ZHOA discloses a method in which polystyrene (plastic material to be heat treated) is heat treated at a temperature ( $110^{\circ}\text{C}$ ) a few degrees above the glass transition temperature of the polystyrene ( $T_g = 100^{\circ}\text{C}$ ) (Page 209, Section I. Introduction).

16. **With regards to claim 5**, URAIRI discloses a method in which the method is carried out while focusing a beam (Page 5, Paragraph [0011]) so as to have a beam

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spot size of the pulse laser beam at the position for processing the plastic material to be processed of between 0.1- 100 $\mu$ m (Page 12 Paragraph [0034], Page 15 Paragraph [0047]).

17. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over ZHAO et al (Fabrication of Microstructures Using Shrinkable Polystyrene Films) and VENKATAKRISHNAN (Laser writing techniques for Photomask Fabrication Using a Femtosecond Laser), 1, 2 and 4-5, in further view of MISAWA et al (Microfabrication by Femtosecond Laser Irradiation).

18. **With respect to claim 6**, modified URAIRI discloses a method of applying a pulse laser beam to a plastic exhibiting a glass phase transition by heating for forming an induced structure part (pattern) (URAIRI Page 4 [0009], [0010], Page 9 [0027] Applicant's Specifications Page 1 Background Art), heating the patterned film to a temperature a few degrees above the glass transition temperature (ZHAO Page 209, Section I. Introduction) and the use of a lens that provides a magnification of 10 times or 20 times (URAIRI Page 18 Paragraphs [0053], [0055]) and the use of a femotsecond pulse laser beam (Page 493, Abstract and Introduction).

19. However URAIRI does not disclose the use of an objective lens of 0.1 to 1.4 numerical aperture.

20. MISAWA discloses a method of laser microfabrication in which an objective lens with a numerical aperture of 1.3 is used.

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21. At the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the method of URAIRI to include the lens numerical aperture of MISAWA because adjusting the numerical lens aperture determines how the pulse is focused, for example a tightly focused pulse has a  $NA > 0.6$  (Page 248, Section 2.2 Optical Damage).

### ***Response to Arguments***

22. Applicant's arguments filed March 12, 2010 have been fully considered but they are not persuasive.

23. With respect to claim 1, Applicant's arguments on Page 8 Lines 14-17, that the references do not teach the newly added limitation of a femtosecond pulse laser beam are unconvincing in view of newly-cited VENKATAKRISHNAN (Laser writing techniques for Photomask Fabrication Using a Femtosecond Laser), as discussed above.

24. Applicant further argues that URAIRI does not disclose scaling down the structure (Page 9 lines 15-23) but that URAIRI is heated to form an induced structure part on the surface of or in the plastic material. The Examiner on Page 4 Paragraph 13 and Page 5 Paragraph 19 of the Office Action dated November 12, 2009, admitted that the individual reference of URAIRI does not teach this feature. However, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Merck & Co., Inc., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

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Therefore the argument that URAIRI does not teach the singular feature cannot show nonobviousness in light of the combined references.

25. Applicant respectfully argues that it would have been difficult for one of ordinary skill in the art at the time to modify the method of URAIRI to include the heat treatment and the temperature of ZHOA (Page 10 lines 2-11 of Applicant's Response). However, "The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference.... Rather, the test is what the combined teachings of those references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). See also *In re Sneed*, 710 F.2d 1544, 1550, 218 USPQ 385, 389 (Fed. Cir. 1983) ("[I]t is not necessary that the inventions of the references be physically combinable to render obvious the invention under review."); and *In re Nievelt*, 482 F.2d 965, 179 USPQ 224, 226 (CCPA 1973). Therefore while Applicant points that it would be difficult, Applicant has not demonstrated that the combined references would defy the principle of operation of the primary reference or render the reference inoperable for its intended purpose.

26. Finally Applicant further contends that the references cited by the Examiner do not disclose a method in which the formed laser process patter is only scaled down by the heat treatment without its shape being changed. However, ZHOA discloses that a rectangular shape was change during shrinking to either a rectangular or rhombic shape



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depending on the alignment (Page 212, Section 3.2, and Figure 3). While ZHOA does not explicitly disclose maintaining the shape, ZHOA further explains that complex shapes (*i.e. the square*) can be fabricated by controlling the extent and direction of the shrinkage of the patterned PS films (Page 215, Section 4. Conclusion). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention that shape (whether maintaining it or distorting it) could be determined by controlling the extent and direction of the shrinkage of the patterned film.

27. As to the dependent claims, they remain rejected as no separate arguments are provided.

### ***Conclusion***

28. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHANIE DUCLAIR whose telephone number is (571)270-5502. The examiner can normally be reached on Monday - Friday, 8:00AM - 4:30PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. D./

Examiner, Art Unit 1713

/Binh X Tran/

Primary Examiner, Art Unit 1713